to him. These sketches should, of course, be very exact, and in order that they may be so, it is necessary that the microscope should be provided with an eye-piece micrometer with which to measure the length and breadth of the figure to be sketched. * * It is so difficult to separate specimens from their accompanying foreign matter that it is seldom amateurs can mount them satisfactorily on slides, and therefore this method of preserving specimens is not open to recommendation."

BOTANICAL NOTES.—Dr. Gray's Revision of the North American species of the genus Oxytropis, communicated to the American Academy of Arts and Sciences, May 14, 1884, and but lately received, is an attempt to clear up some of the obscurities of the subject. Sixteen species are recognized as occurring in North America, but one of which occurs on the Atlantic coast, viz., *O. campestris* L., in Northern Maine, Lower Canada and Labrador. A second species, *O. lamberti* Pursh, occurs from the Saskatchewan river, Minnesota, and Western Texas, westward to New Mexico and Montana. Two varieties of this species are noted, viz., var. *sericea* (*O. sericea* Nutt.) from Wyoming to Texas and Arizona, and var. *bigelovii* (*O. lamberti* Torr., in Pacific R. R. Rept., IV, 80) on the Upper Canadian river. All the other species are from the Rocky Mountain region and Alaska.——With the foregoing we have also Notes on some American species of Saxifraga, by the same author.——Joseph F. James' Contributions to the Flora of Cincinnati, in the *Jour. Cin. Soc. Nat. Hist.*, contains many interesting notes on certain plants of the Cincinnati flora.——In an interesting paper, "Untersuchungen über die Bildung von centrifugalen Wandverdickungen an Pflanzenhaaren und Epidermen," just received, the author, Heinrich Schenck, discusses the thickening of the cell-walls of hairs and epidermal cells. A large plate with numerous figures illustrates the paper. —— *Drugs and Medicines of North America* is the name of a promising new quarterly illustrated journal devoted to the discussion of the botany, pharmacy, chemistry and therapeutics of the medicinal plants of North America. It appears to be worthy of support. It is published by Lloyd Bros., 180 Elm street, Cincinnati, Ohio, for $1 per year.

ENTOMOLOGY.

LIFE HISTORY OF LOCHMÆUS TESSELLA.—The caterpillar of this moth is one of the most interesting among the Notodontians since it connects Cerura with the other genera, by reason of its two long caudal filaments, so much like those of Cerura. These appendages are simply modified anal legs, and seem to be tactile organs. This caterpillar is also interesting from its power when touched of forcing out a dense cloud of fine spray from a point near the head; exactly where this repugnatorial apparatus is sit-

uated is difficult to say; as yet I have been unable to find it with a hand-lens. It is very common on the oak, from Maine southward, in August and through September.

It is a large-bodied, pale green caterpillar, thickest in the middle, being somewhat spindle-shaped. The head is moderately large, flat in front, subconical, with the vertex high and conical, pale green, edged very irregularly with roseate on the sides. A small double reddish tubercle on the top of the prothoracic segment, from which a median white or yellow dorsal stripe, here and there marked with roseate spots, runs to the supra-anal plate. The anal legs are represented by two slender filaments held outstretched, which are nearly as long as the body is thick. There are seven pairs of oblique lateral faint yellowish slender stripes, the last pair extending to the sides of the anal filaments. All the legs are pale green and concolorous with the body. Length 40$^{mm.}$ including the filaments.

The young before the last moult have much higher prothoracic dorsal tubercles and much larger anal filaments than in the adult, and they are tinged with reddish. The cocoon is of silk, not very thick, spun between the leaves, and in confinement the moths issued in November, though ordinarily not due until June. —*A. S. Packard.*

TRANSFORMATIONS OF CARIPETA ANGUSTIORATA.—The caterpillar of this geometrid moth is common on the white pine in August and September in Maine and Rhode Island, where I have observed it, and is protected from observation by its resemblance to the smaller twigs of the pine. It is quite variable in its coloration. It is rather large and thick-bodied, the body being somewhat thickened at the first pair of abdominal legs. The head is slightly angular above, as wide as the segment next to it, the latter being rather small and not angular in front, but provided with small warts. On the metathoracic and abdominal (except second and third from the end) segments is a prominent transverse saddle-shaped ridge, ending on each side in a dark warty tubercle. On the penultimate segment are two dark, rather high dorsal tubercles, situated near together. Behind these two tubercles, and situated on a transverse wrinkle, are two small dark warts, and on a succeeding wrinkle are six warts; on the supra-anal plate are four warts, while on the edge, which is obtuse, are four small warts from which project four hairs. There are similar hairs on the edge of the anal legs, which have a deep crease parallel to the front edge, and two large spines. Lateral ridge rather prominent, interrupted at the sutures between the segments.

In color this larva is pale lilac, with whitish gray specks, being of a slate color or decidedly reddish, like a twig of the trees, and variously marbled with dark brown, or sometimes with greenish livid white. The head is marbled with transverse parallel waved lines. Length 30–32$^{mm.}$ August 8–9, at Brunswick, Me., it spun

a white web with minute meshes; the cocoon not being a loose one; and on the 9th it assumed the pupa state. The chrysalis is brown, sometimes green on the head and thorax, including the limbs and wings; with an obscure dorsal row of irregular spots, forming a nearly continuous line or band; and a lateral row of large obscure spots. On the second segment from the end of the legs are two warts. The spiracles are unusually distinct. Length $15^{mm.}$ The moths issued in May in the breeding boxes.—*A. S. Packard.*

THE LIMBS OF INSECTS.—In his inaugural dissertation Dr. F. Dahl considers the structure and function of the limbs of insects. After the usual historical preface the author considers, without entering into anatomical details, the external structure of the leg, but devotes more space to the mechanism of the muscles. The insect limbs are then regarded from the point of view of their special functions, *i. e.* the limb as an organ of motion, whether on the ground, in water, or in the air. Under this head are given histological details, with figures filling three plates and showing the fine anatomy of the tarsal joints, claws and pulvilli as well as hairs, as well as the external appearance of the last tarsal joints of insects of different orders.

The limbs are then treated of as organs of prehension, including reproductive purposes as well as their uses in cleansing and combing the head, antennæ and mouth parts, with sketches of the different kinds of combs growing on the fore-legs of beetles, bees and wasps, etc.

POISON GLANDS IN THE SKIN OF THE CECROPIA CATERPILLAR.—Dr. Dimmock, in the course of a valuable article on "Some glands which open externally on insects," in *Psyche*, for September–October, 1882 (published in February, 1884), states that, if a Cecropia caterpillar "be examined carefully, the black spines upon its red, blue, and yellow knobs, or tubercles, will be seen to break easily from the tubercle, and a clear yellow fluid of disagreeable odor to ooze from each opening left by the injury. By crushing the tubercle with a pair of forceps, the same strong odor is very noticeable, and by this mode of treatment one has no difficulty in proving that each tubercle, small or large, blue, yellow, or red, contains the odorous fluid. The red tubercles are seen, in sections cut with the microtome, to be divided into compartments, the cavities of each spine opening into a compartment at its basal end. The spines themselves are quite rigid and very brittle, so that they break away at a slight touch, and leave a hole in the tubercle, out of which the odorous fluid pours, pushed by internal pressure. This fluid, which I have not examined carefully, but which I hope later to study chemically, is strongly acid to litmus paper, but causes a purple precipitate in carmine solutions." The odor given out by these glands suggests at

once their protective function. Similar glands, *i. e.*, with no outlet until one is produced by external agency, are not rare in bombycid larvæ. Karsten, in 1878, described the anatomy of the poison glands at the base of the hairs of an American Saturnia. The secretion is "perhaps formic acid or a formate in solution." The paper is crammed with interesting facts on this subject; among others it is stated that, according to Witlaczil, the "honey" secreted by the aphides issues from the anus, and not from the tubes on the sixth segment.

MALPIGHIAN VESSELS OF LEPIDOPTERA.—M. Cholodkorsky has lately added *Lineola biselliella* to the list of the few insects that are known to have only two Malpighian vessels; these are of some size, and are folded along the course of the digestive canal, and end by a distinct enlargement. Luckow has described four Malpighian vessels in a species of Pterophorus and of Hyponomeuta, but later investigations show that they really agree with the great majority of the Lepidoptera in having six. As embryological research has shown that a small number of Malpighian tubules is a primitive character, and that with progressive development the number increases either by branching or by histolysis, succeeded by a fresh development of a larger number, it is clear that the Microlepidoptera in which there are but two, while their caterpillars have six, exhibit just the reverse to what we should expect, or in other words we have here a case of atavism, and one which as it obtains in the imaginal state only, is here a periodic rather than a constant atavism.—*Journal of the Royal Microscopical Society, June, 1884, p. 373.*

TRANSMISSION, PRESERVATION AND MOUNTING OF APHIDES.—G. B. Buckton gives the results of his experience as to the best mode of transmitting living Aphides, and also the best method for killing and preserving such like insects for future examination.

As to transmission, the chief thing to be guarded against is desiccation, and no plan seems to be so successful as their inclosure in ordinary quills stopped by plugs of cork and pellets of beeswax. The substance of the quill is sufficiently porous to prevent mildew on the one hand and a rapid evaporation on the other. In this way small insects may be sent through the post, and in a far better condition than can be secured in any tin boxes, even though they be filled with leaves. If a slip of somewhat succulent leaf be rolled round each quill, to retain moisture, a bundle will conveniently pass through the post.

For preservation (other than on a slide) the best plan is to drop the insects into small flattened glass tubes partially filled with a suitable liquid, then draw the tube to a fine point, break the end off, and warm the empty space (or, better, expel the air by a pump), and the tube can be entirely filled with liquid, and then sealed with the blow-pipe.

For mounting microscopically, five or a dozen spots of fluid Canada balsam should be dotted on a slide from the head of a pin, and by means of a hair pencil as many living insects transferred to them. The specimens at once adhere, and if the spots are small the insects spread out their limbs naturally, with a view to escape. They may be fixed on their backs or otherwise, according to the views desired.

A very thin glass cover, or, if very high magnifying powers are wanted, a small disk of clear mica, is laid over the insects, and then one or more drops of the fluid balsam are delivered from a glass rod at one of the sides of these covers. The balsam runs slowly under by capillarity, and it drives all the air before it, the small weight of the cover assisting it to spread, until the whole area is filled. No pressure is to be used, or the elastic bodies of the Aphides will change shape; and besides this, the juices will be forced through the cornicles and pores. If the balsam is thick, a very gentle heat, hardly exceeding that of the cheek, may be applied, but as a rule, the temperature of a room is better than that which exceeds it. The insects die immediately they are cut off from air, and in almost every case their position will be good for examination. To spread the wings of a small insect, the above-mentioned small dots may be made in a row. The belly of the specimen is applied to the middle spot, and by a bristle one wing may be applied to a dot on the one side, and the other wing to the third dot. The cover is then placed as before, and when the balsam runs in it will not disturb the position of the spread wings.

It will be noticed that very soon after live insects have been mounted in a resinous substance that will not mix with water, a white cloudiness forms around each specimen. This is caused by the watery juices of the insect, which chill the medium and make it opaque.

This cloudiness, however, entirely disappears after perhaps a month, the moisture being slowly carried outwards. The same is to be said of stray air-bubbles. The oxygen of the air unites with the balsam, and thus hardens it; but what combination is effected with the nitrogen is not so clear. However, air-bubbles in balsam disappear in time, provided the former is not in too hard a condition.

In cases when the above small pressure is undesirable, small circles, cut by round punches of different sizes out of very thin sheet lead, will be found more convenient to insert between the glass slip and its cover than circles of card, which are sometimes recommended. The thin sheet lead from the Chinese tea-chests is very suitable for punching, and as it is not porous like card, it yields no air-bubbles by heat.

D. Von Schlechtendal has described a method by which it would appear that all the characters of form and colour (?) may be preserved in Aphides and other insects. The method consists

of a rapid death and drying of the insect by means of a current of heated air. The Aphis, previously attached to some suitable support, is suddenly and momentarily subjected to the heat of a spirit or other flame, by which it is immediately killed and caused to retain its natural position. Several examples are then carefully roasted in a current of hot air, such as that passing through an inclined glass tube duly made hot, or dried on a sheet of paper moved over a heated metal plate.

When dry, the specimens are mounted on card by attachment with gum tragacanth, or, as Mr. T. W. Douglas suggests, more conveniently on mica, called "talc," in the shops, which, as it is incombustible, is well suited for a support both before and after drying.

This method is vouched for as good by Drs. Giebel, Taschenburg, Mayr and Rudow. I have not tried this roasting process, but it must require some address to prevent the shriveling of wings in such delicately formed insects, and to provide against the bursting action of the boiling juices. A more complete history of the process than the foregoing was given by Mr. Douglas in 1878.

M. Lichtenstein has many times been good enough to forward in letters to me preparations of Aphides which have been secured between two films of mica. The insects, he explains, are immersed in a solution of resin in turpentine, "a natural amber," and, when all are in due position, the mica films are placed over apertures in card, and then gummed papers, similarly perforated, are pressed upon them. This arrangement secures all in their places.

Methods and operations in science, like events in history, repeat themselves. Fifty years ago films of mica were used to cover objects for the microscope, and before the manufacture of the thin glass now so commonly used, it admirably answered its purpose. Under deep magnifying powers, such as one-half inch, it will be found even now of great service. The mineral may be split by the lancet into films much thinner than glass can be blown in a flat state. Small unscratched pieces may be selected which are perfectly transparent, and their cost is quite trifling.

On account of the high refracting power of Canada balsam, the colors of recently immersed Aphides show themselves very brightly; and it sometimes happens that tints, quite lost through irradiation or glance on the surfaces, become distinct by treatment with this resin.

The bright colors and markings of some species are due to the hue of the internal juices of the insects. These cannot be preserved by balsam, but it is otherwise with the pigments which stain the somewhat horny coverings of the thorax and abdomen. These colors are persistent.—*Journal of the Royal Microscopical Society, June, 1884, p. 467.*